Morphological and Cytological effects of Chemicals on Male Gametocides in Onion

by

S. KUMAR[1]

Introduction: By rendering the male sterility in self pollinated crop like onion, the artificial emasculation need not be resorted to. The male-sterile plants will be effective females for a crossing programme. It is, therefore, necessary to study influence of these chemicals on morphological traits as well as their cytological and sterility producing effects.

Materials and Methods: The recommended variety, "Pusa Red" was sown in a randomised block design with four replications during 1964. Three injections were given in the scapes before flower initiation with three chemicals as shown in Table 1.

TABLE 1.

Concentrations ppm	Maleic Hydrazide	Nepthalene Acetic Acid	Beta Indole Butyric Acid	Control
10	T_1	T_4	T_7	(No treatment)
50	T_2	T_5	T_8	T_{10}
100	T_3	T_6	T_9	

The observations were recorded on characters such as scape length, plant and leaves diameter, pollen size, seed-setting, sterility percent, ovule fertility and cytological study of pollen mother cells.

Results: (A) *Morphological characters:* The chemicals treatments have reduced the scape length significantly. The decrease was marked in low concentrations of all the chemicals. Amongst the chemicals, MH was more effective followed by Beta IBA and NAA. Similarly significant reduction was also noted in the case of leaves and plant diameter in all the treatments. Beta IBA showed a highly significant increase in the pollen size followed by NAA & MH. The seed setting was, however, not significantly increased by the chemicals (vide Table 2). The 'F' test indicated that all the above characters were highly significant for variance at both 5 and 1% levels.

1. Research Assistant (Maize), P. A. U., Ludhiana (Punjab).

TABLE 2. *Effect of various chemicals treatments on different characters of onion plant*

Treatments	Scape length (cm)	Plant diameter (cm)	Leaves diameter (cm)	Pollen size (Mue)	Seed setting (g)
T_1	53.25	1.72	0.70	18.7	27.10
T_2	54.00	1.62	0.73	21.3	25.00
T_3	57.25	2.24	1.45	23.0	22.50
T_4	69.00	2.30	1.18	21.1	26.00
T_5	76.50	2.40	1.17	23.6	25.40
T_6	74.75	2 65	0.69	26.1	23.45
T_7	67.25	1.90	1.55	23.2	25.50
T_8	67.50	2.31	1.17	24.7	23.75
T_9	64.75	2.35	1.07	28.9	20.87
T_{10}	83.00	2.40	1.17	18.1	28.13
C.D. @ 5%	4.32	0.59	0.71	0.72	1.06
SE @ 5%	—	0.99	—	1.20	1.79
SE @ 1%	—	1.36	—	1.69	2.45

Pollen sterility was observed increasing from first to third induction. It was observed varying from 72.0 to 92.0 to 92.0% after the last induction. It was high in the plants treated with higher concentrations (100 ppm). In no case sterility (pollen) was less than 72.0% (Table 3).

TABLE 3. *Percentage of Pollen sterility at various stages of growth (after 7 - 10 days of flower initiation)*

Treatments	Average of three lots taken at constant intervals after each spray		
	1st time	2nd time	3rd time
T_1	—	27.0	72.0
T_2	—	42.0	83.9
T_3	44.0	53.0	90.1
T_4	43.1	58.0	69.8
T_5	42.0	58.2	83.3
T_6	33.5	56.0	92.0
T_7	52.8	70.0	89.0
T_8	38.5	60.0	88.7
T_9	27.8	33.7	90.8
T_{10}	0.0	0.0	0.0

In only six treatments, ovule fertility was observed (vide Table 4). When the treated plants were selfed, only 1.5 to 3.4% seed setting was observed. However, in one treatment of low concentration, 8.0% seed setting was noted which gave the indications that higher doses were more effective for the sterility. Further, when the plants from these plots were hand pollinated with normal pollen, 79–93% seed setting was observed. This clearly indicated that no chemical was injurious for the ovule fertility.

TABLE 4. *Effect of chemicals on Ovule fertility*

Treatments (ppm)		Percentage of seed setting by	
		selfing	crossing with normal plant
MH	100	1.5	86.4
NAA	50	3.4	80.0
NAA	100	0.0	89.6
IBA	10	8.0	79.6
IBA	50	0.0	80.4
IBA	100	0.0	93.0

(B) *Cytological study:* Male sterility is characterised by the lack of viable pollen grain production. It may be caused by a variety of disturbing events occurring anywhere along the sequence of steps from premeiotic stage of normal pollen productions (Rick, 1958).

Stickiness was throughout prevalent but were more marked with higher concentrations. Leggards and bridges were also prevalent but in low numbers. Similarly, univalents, un-balanced and fragments were of common occurrence among all the concentrations. However, un-balanced cells were more marked varying from 2-21 numbers. Particularly, Beta IBA gave 12–17 unbalanced cells. In general, 71.6% abnormal cells were observed. The extent of the abnormalities were more marked with higher concentrations (Fig. 1). These abnormalities were mostly noted at first anaphase (Table 5).

TABLE 5. *Aberrations in the microsporogeneses of onion plants treated with various chemicals*

Number of pollen mother cells showing	Treatments								
	1	2	3	4	5	6	7	8	9
Stickiness	12	13	11	4	13	15	8	17	13
Laggards	2	1	2	1	2	1	—	7	3
Bridges	9	3	—	—	2	1	4	7	11
Univalents	4	2	—	2	2	5	2	9	4
Unbalanced	10	5	8	2	—	12	16	17	21
Fragments	3	2	1	3	1	4	—	3	5
Total number of cells showing aberrations	40	26	21	12	20	38	30	60	57
Number of normaal cells	11	9	—	5	—	2	13	9	—
Abnormal cells %	78.8	74.3	100	71.6	100	98.0	69.8	87.0	100

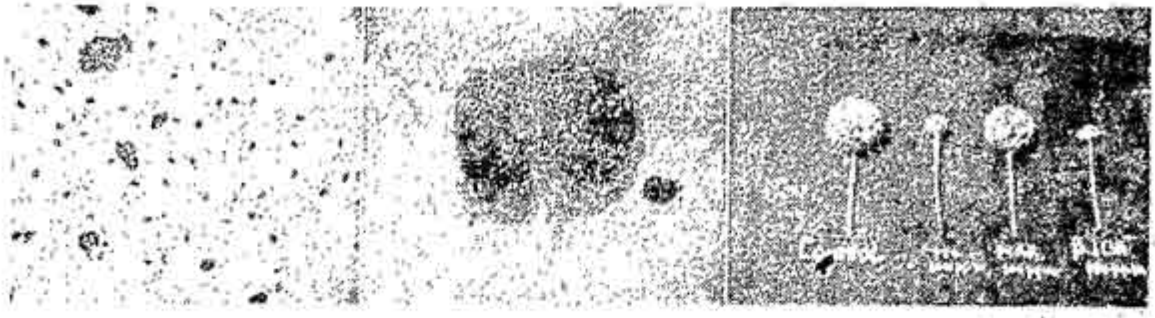

FIG. 1 FIG. 2 FIG. 3

Discussion: The chemicals produced high percentage of sterility. 80 to 93% of seed setting was observed when the sterile plants were hand pollinated with the normal pollen which indicated that chemicals were not harmful to ovule-fertility. The vegetative characters like scape length, plant and leaves diameter were found decreased. This is in conformity with Peterson and Foskett's (1953) report in Onion for reduced flower size and Jones (1950) for dwarfness of sterile plants in corn. Reduced seed-setting with higher concentration is in conformity with Richmond (1962) who noted the reduction in amount of lint and seed production in cotton. The low concentration did not have any effect on the seed setting and 80% sterility was gained. Thus, it may be mentioned that low concentrations (10 ppm) seemed to be better suited for this crop for producing the hybrid seed. It might be also argued here that with this same concentration and a more critical timing of application complete sterility may also be achieved.

The medium concentrations (50 ppm) of the chemicals may also be desirable where very little difference was recorded from low concentrations in seed setting. So, the same may also be desirable for hybrid seed production schemes if the economic considerations are ignored.

After every spray, sterility was increased, which may be due to the residual effects of the chemicals. Some dried inflorescences were also noted (Fig. 2) which may be due to the complete sterility as Chopra (1960) has reported in the tomato.

Summary: The 'Red Pusa' variety of onion was sown in randomised block design with four replications for the study. Maleic hydrazide, Nepthalene Acetic Acid and Beta Indole Butyric Acid were used to induce sterility. Effects of the treatments on scape length, leaves and plant diameter, pollen size and seed setting and cytology were studied. The chemicals affected all these characters. The lowest concentrations (10 ppm) of all the chemicals seemed to be better suited for this crop for producing the hybrid seed. The medium concentrations (50 ppm) of all the chemicals may also be desirable for the same as very little differences were noticed.

Acknowledgements: The author is grateful to Shri R. Singh, Associate Professor for his valuable guidance and assistance and to Dr. M. S. Swaminathan of I.A.R.I. for valuable advice. He is also grateful to Dr. V. Kumar and Dr. Tandon of the Punjab Agricultural university, Ludhiana for their help in presenting this paper.

REFERENCES

Chopra, V. L. 1960. Studies on the chemicals induction of pollen sterility in some crod plants. *Ind J. Gen.*, 5 : 43.

Jones, D. F. 1950. The inter-relation of plasma-genes and chromosomes in pollen production in maize. *Gen.*, 35 : 507–512.

Peterson, C. E. and R. L. Foskett. 1953. Occurrence of pollen steritity in seed fields of Scott County globe onions. *Proc. Amer. Soc. Hort Sci.*, 62 : 443–8.

Richmond, T. R. 1962. Effect of sodium ; 2, 3 D on six characters of Amer. upland. Cotton. *Crop Science*, 2 : 59–60.

Rick, C. 1958. Disturbed seggregations in progenies of L. esculentum×. chilense. Proc. 10th Intern. Cong. *Gen.*, 2 : 232–3.

Effect of Seed Inoculation with *Rhizobium* on Yield and N Content of Green Manure Crops

by

K. S. NAIR[1], RANI PERUMAL[2], AKBAR KHAN[3] and P. P. RAMASWAMY[4]

Inoculation of legumes, with effective strains of *Rhizobium*, has been a major factor in improving their yield and quality (Erdman, 1953). Studies conducted for the past several years have conclusively shown that the naturally occurring *Rhizobium* inhabiting the soils for a number of years, gradually loses its efficiency with time, and hence an introduced efficient strain of *Rhizobium* can establish better in the root-zone of the legume in competition with the local strain (Manil and Bonnier, 1949). The necessity for selecting suitable strains of *Rhizobium* to bring about maximum benefit to the legume crop has also been brought out in their studies with *Cajanus cajan* (Ramaswami and Nair, 1965). Data also show that a more effective strain of legume bacteria can increase yield or protein content of legumes as much as 20% on the average, over the natural legume bacteria in the soil (Erdman, 1953).

Since the strains that prove to be of highest benefit under field conditions, will be the ones in great demand by farmers, the search for new and better

1 Agricultural Bacteriologist, Agricultural College and Research Institute, Coimbatore-3.
2, 3 and 4. Assistants in Bacteriology, Coimbatore-3.